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AUTHOR Jones, Dionne J.  
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## ABSTRACT

This paper reviews the hallmark studies of field dependence-independence and considers the evidence for sex and ethnic differences in cognitive style. Research has traditionally linked females' early verbal superiority with field dependence and males' superior visuospatial skills with field independence. Studies challenging this picture cite factors that may be generating these performance differences, including noncomparable math background and divergent socialization of boys and girls. Cross-cultural studies indicate a relation of cognitive style differences to the degree of sex-role differences enforced in the culture. Various factors in the culture of black Americans are seen as promoting cognitive style differences and greater field dependence. These include kinetic-tactile rather than visual information processing emphasis and a person-oriented rather than object-oriented cue selection style. These differences may place black students at odds with the dominant style expected in school curricula, especially in math and science. However, black students are more likely to excel in math/science and choose science-related careers if they establish a strong relationship and perhaps role identification with a math/science teacher. The paper offers various ways to enhance learning environments by accommodating to cognitive style differences. (LPG)

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COGNITIVE STYLES: SEX AND ETHNIC DIFFERENCES

Dionne J. Jones \*

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\* Ms. Jones is a Research Associate with the National Urban League and a doctoral candidate in the Department of Psychoeducational Studies, Howard University - (Ph.D. expected Summer 1987).

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## Introduction

There is some consensus among researchers that the information processing system is different for men and women as well as among ethnic minorities. No value judgements should be placed on these differences. They are not deviant, merely different. In fact, some researchers have theorized hormonal and sex-linked genetic factors in the development of field-independent and field-dependent cognitive styles (Broverman et al., 1968). Other have cited cross-cultural studies to identify sources of sex differences in field-dependence-independence (Witkin and Goodenough, 1981).

Problems in school achievement have been related to the field dependent cognitive style. This paper will illustrate some studies that have found specific differences in cognitive styles between males and females and in ethnic minorities.

## What are Cognitive Styles?

The concept cognitive styles is one of three major categories of student learning styles. The other two categories of student learning styles are: affective and physiological styles (Hunt, 1979). This paper will focus on cognitive styles.

The product and the process of thought and the acquisition of information and knowledge are what is meant by cognition. And the manner in which an individual acquires and processes information is said to be his cognitive style. Cognitive

styles have been described as "information processing habits representing the learner's typical mode of perceiving, thinking, problem solving and remembering" (Keefe, 1979).

According to Witkin et al. (1977), cognitive styles are hypothetical constructs used to explain behavior across a variety of situations. Further, they stated that cognitive styles refer to the characteristic ways in which individuals conceptually organize the environment. They are not the same as abilities.

Messick (1979) differentiated cognitive styles from abilities in four ways. First, he stated that abilities deal with the content of cognition (the question of 'what'), whereas style refers to the manner in which behavior occurs (the question of 'how'). Second, Messick observed that abilities tend to have a unipolar dimension with a single attribute (e.g., intelligence), whereas cognitive style measures are bipolar dimensions with two opposing attributes (e.g, field dependent-field independent). Third, Messick pointed out that a value is attached to ability, but no value is attached to cognitive styles. Each end of the continuum is assumed to have positive value. Finally, Messick stated that abilities are related to specific content areas, while cognitive styles are related to a wide variety of behaviors and situations.

Researchers have identified as many as 20 different cognitive styles (Keefe, 1979). Each cognitive style represents a continuum of style in information processing, and each person has a place somewhere on that continuum.

One such continuum is the cognitive style dimension of field independence and field dependence -- the focus of this paper.

As developed by Witkin (1978), the concept field independence refers to "the tendency to rely primarily on internal referents in a self-consistent way." Field dependence, on the other hand, refers to the "tendency to give credit to external referents."

In the field independent style, there are firm boundaries between oneself and the external world (namely, other people). Field independent persons have strong internal frames of reference, and this style has been associated with many cognitive problem solving skills necessary for manipulating and restructuring the world through symbolic thought processes. These are the skills presumably necessary for academic success.

At the other end of the continuum, field dependent persons have an overall interpersonal orientation. Typically, they rely on information provided outside themselves. Based on his research to test for field independence and field dependence, Witkin (1978) found that field dependent persons are more accommodating to others than field independent persons. Further, they have a greater tendency to take other people's views into account. Witkin (1978) cautioned that these two cognitive styles are not mutually exclusive within any one person and, therefore, should not be considered as an absolute dichotomy.

Some of the attributes of field independent people include the valued characteristic of developed cognitive restructuring skills, and the less valued attributes of being inconsiderate,

manipulating people as a means of achieving personal ends, and "cold" (Witkin and Goodenough, 1981, p. 59). Some attributes of field dependent people include having less developed cognitive restructuring skills, but socially desirable characteristics such as being tactful, "warm," accommodating accepting of others, and wanting to help others (Witkin and Goodenough, 1981, p. 59).

Witkin and Goodenough (1981) pointed out that the bipolar dimension field independent-field dependent is value-neutral. Each style can be adaptive in a particular context. Finally, they asserted that people are likely to choose and achieve in educational-vocational domains to which their cognitive styles suit them.

### Some Differences in Intellectual Functioning

#### Related to Cognitive Styles

Based on their research, Witkin and Goodenough (1981) stated that there was a strong relationship between cognitive style and overall achievement (e.g., college grade point average). Moreover, they observed a relationship between cognitive style and performance in specialized areas, at the college level (e.g., Math and Science).

In fact, Witkin et al. (1977) suggested that the field dependent student may be at a disadvantage. For example, field dependent students may need more explicit instructions in problem solving strategies or more exact definitions of performance outcomes than field independent students. Moreover,

Witkin et al. (1977) found that relatively field dependent students are not likely to do as well in math and the science as the more field independent students -- given the way these disciplines are taught.

Some researchers have suggested that field dependent individuals may not perform as efficiently as field independent individuals on standardized tests (Saracho and Spodek, 1984). Witkin et al. (1977) noted that field independent learners actively abstract and cognitively restructure important information by breaking up an organized field into its basic elements and by providing structure for an ambiguous stimulus complex, whereas field-dependent learners display a more passive, spectator approach to learning by processing the stimulus structure as given. It is generally believed that field dependent learners are helped by increased stimulus structure or by aids that initiate a personal restructuring of the material.

Goodenough (1976) asserted that field dependent and field independent individuals differed more in their learning and memory processes than they did in how much they learned and remembered. Others (Davis and Frank, 1979) emphasized developmental differences in effectiveness of performance between field dependent and field independent learners, with field independence increasing with age, up to 16 years.

Davis and Frank found that memory performance (e.g., concept learning) of field dependent learners tended to be poorer when the task required an increased amount of information

to be processed in working memory. However, when there was interference or when the information load was high, field independent students tended to be more effective in recalling information stored in short term memory than field dependent students. In the absence of interference, however, and with limited information, no difference was found between field independent and field dependent students (Davis and Frank, 1979). In summary, field independent persons are more effective than field dependent persons in concept attainment, selective attention and long term memory processes. In addition, field dependent students prefer material with personal content while field independent students prefer material with impersonal content (Davis and Frank, 1979).

Spiro and Tierre (1980) found that field dependent students, unlike their field independent peers, were unable to utilize a schema to aid their recall and retrieval of information. These researchers theorized that field dependent learners were unable to impose a previously-acquired, applicable schema on a new form of information. Thus, the researchers concluded that field dependent students were more "text-bound" than field independent students.

In a similar vane, Konkiel (1981) found that color cueing aided field dependent students to acquire map skills. However, the facilitative effects of color-cueing was not as great for field independent students. Konkiel, therefore, concluded that color cueing helped field dependent students to disembed critical features of the map from the complex map field.

### Sex-Related Differences and Cognitive Styles

It is generally agreed that females are verbally precocious compared to males. Although males eventually catch up, females are thought to retain a slight edge in all areas of verbal functioning (Sherman, 1978). A somewhat different picture emerges in the area of spatial disposition. Most of the research in spatial perception looked at visual-spatial perception and used male subjects.

Males have been found to be superior to females in visual-spatial perception (Maccoby and Jacklin, 1974). Spatial skills are regarded as being important to success in fields such as engineering, mechanical arts, architecture and mathematics. Spatial skills are related to the field independent cognitive style.

Sherman (1978) objected to the commonly held view that males are superior to females in visual-spatial skills. First, she pointed out that different tests are used to measure those skills. Secondly, differences between the sexes in spatial training had not been controlled, and doubtless favored males. Moreover, based on her own research, Sherman (1978) observed that when the school curricula was similar for the two sexes, there were few discernible performance differences.

Contrary to earlier evidence which suggested that the male advantage emerges in early adolescence and is maintained in adulthood (Maccoby and Jacklin, 1974, p. 94), Sherman and her colleague (1977) found that when previous math background was controlled, differences in math problem solving between the sexes

were nonexistent or minimal.

There is some consensus that socialization processes affect girls' performance in math and science (Aiken, 1970; Fennema, 1984; Travers and McKnight, 1985; Lockheed et al., 1985; Moody and Linn, 1986). Aiken (1970) suggested that noted sex differences in math achievement may be the result of greater cultural reinforcement of interest and pursuit of mathematics in males at the higher grade levels.

Fennema (1984) posited that the difference between males and female students in mathematics course taking, as well as in achievement was most likely due to stereotyping math as a male domain. Fennema observed that although both males and females felt that math was not a male domain, males were less strong in their views and differed significantly from females.

Travers and McKnight (1985) also found that in general, students do not view math as a male domain. However, for girls who perceive math as a male activity, achievement was at a lower rate than for girls who did not. On the other hand, Lockheed et al (1985) found that girls who attended schools where math was not seen solely as a male subject, have been found to be better problem solvers.

Moody and Linn (1986) assert that differential interests and styles of play are encouraged for boys and girls which may help boys to achieve success in math and science. For example, boys watch more TV science shows, read more books, magazines and newspaper articles on science, and work more with science

projects and hobbies. Moody and Linn further contend that girls are more often reinforced to interact on a social level and to be familiar with social rules. These are all related to the field dependent dimension of cognitive styles.

Somewhat related to the cognitive style preferred by males and females are the differences in their attributional styles. Wolle et al (1980) found that males exhibit the desirable behavior patterns of mastery orientation more than females. Males attribute their success more strongly to ability, whereas females tend to attribute success to effort at all levels of achievement. Females tended to attribute their failure to lack of ability or difficulty of task. Attributional styles exhibited by females lead to avoidance of difficult tasks that in turn lead to lower performance, a learned helplessness (Fennema and Peterson, 1985).

Witkin and Goodenough (1981) noted that the finding that males tend to be more field independent than females has drawn attention to the possible role of hormonal and sex-linked genetic factors in development of the field-independent and field-dependent cognitive styles. To explain the sex differences in cognitive functioning, Broverman et al. (1968) proposed a biochemical theory that has been severely criticized. They proposed that estrogen affects the patterning of cognitive abilities.

Witkin and Goodenough (1981) observed that cross-cultural studies have also identified sources of sex difference in field independence - dependence. In general, the more pronounced the differences between male and female roles, the greater the

likelihood that there will be differences in cognitive styles.

### The Impact of Ethnic Differences and Cognitive

#### Styles on Academic Achievement

Based on empirical evidence, some researchers have concluded that minorities tend to be field dependent (Olstad et al., 1981; Ramirez, 1982). These stylistic differences are believed to be related to lower academic achievement by Blacks. Shade (1984) noted that Black Americans have developed unique cultural patterns and a specific method for organizing and processing information.

By way of explaining the unique pattern of cognitive strategies or the field dependent cognitive style of Blacks, Shade (1984) developed an information processing paradigm. The paradigm illustrates the way that Black Americans perceive, encode, represent and analyze information. Shade pointed out that the preferred modality for receiving information in the American culture is visual. However, among Black Americans, the emphasis is on the kinetic and tactile senses.

The cue selection of Black Americans is also different from that used by the majority culture (Shade, 1984). The selection of cues is important for encoding and representation of information that will be retained from the barrage of information to which one is exposed. The literature suggests that Blacks are socialized to be person-oriented rather than object/thing-oriented (Shade, 1984; Prom, 1982). Thus, the cue

selection preference for Blacks were people and events as opposed to ideas and objects.

It has been suggested that ethnic differences in cognitive styles may be responsible for ethnic differences in academic performance (Shade, 1984; Olstad et al., 1981). The preferred cognitive style used by minorities is incompatible with current school practice (Olstad et al., 1981; Schimizzi, 1981). The incompatibility seems greater in mathematics and science where analytic skills, an abstract and often impersonal orientation, and working independently are more heavily relied upon (Olstad et al., 1981).

These researchers suggested that cognitive style seemed to account for differences in math achievement more fully than for differences in reading. They recommended that science and math instructions should include the use of more global skills, a more personal orientation, and more group work to facilitate positive social interactions. They believed that such accommodation, would enable the science and math classroom to become a more comfortable domain for more ethnic minority learners (Olstad et al., 1981).

Johnson and Prom (1984) also reported that their sample of minority professional men and women rated their high school counselors and teachers positively and indicated that they were receptive and responsive to their interests. In fact, students who reported that a science or math teacher had the greatest impact on them in elementary or high school, tended to choose science or math--related careers.

Other indications of the importance of social nuances or the interpersonal domain among Black Americans have been confirmed by several researchers (Matthews, 1981; Hall, 1981). These researchers found that Black students attributed their high achievement orientation to the influence of warm and supportive teachers. Matthews found that Black students preferred a mathematics teacher who would 1) give them a second chance to pass the test; 2) stay after school to work with them; and 3) follow the textbook page by page. Among a group of female minority scientists, it was found that race of the school staff affected their attitudes and aspirations (Hall, 1981; Kenschaft, 1981). These scientists stated that Black teachers, counselors or administrators inspired them and influenced their decision to continue in a mathematics- or science-related career. In addition, Hall (1981) noted that minority women scientists continued to enroll in mathematics courses when they were placed in small classes, a more advanced track, and started early to fulfill the prerequisites for more advanced classes.

Olstad et al. (1981) pointed out that some minorities perceived scientists and mathematicians as being highly intellectual, inflexible and socially isolated. These traits tend not to be highly valued in minority cultures. In addition, a very small percentage of minorities are represented in those fields which creates a problem of role models for minority students.

### Implications for Education

Based on this presentation, it is clear that respected researchers in the field have substantially underscored that Blacks and women process information different from white males. These groups have a tendency to be more field dependent. What, then, does this dictate for the educational system?

First, we must teach them in a mode that is more facilitative to their learning and cognitive styles. We saw, for instance, that Blacks utilize the kinetic and tactile senses more than the visual. Therefore, in a science class, for example, students would grasp the material more readily if they were involved in real life activities that were meaningful.

Schimizzi (1985) offers some practical suggestions to aid student learning of math. Utilizing a Piagetian model, he emphasized that abstract concepts should be supported by three dimensional manipulative teaching devices or models such as blocks, beads, abacus and rods. In addition, two dimensional tools might include diagrams, sets, designs, arrays or number lines which relate algorithms or equations to specific visible corresponding representations.

Schimizzi (1985) asserts that regular college courses have little, if any, effect on the development of the skills required for formal operations thinking. Since formal operations thinking is an ability required for the completion of some college courses, it is important that schools and colleges aid students in developing the cognitive processes while stimulating and

nurturing skilled reasoning, problem solving, and precise analytical thought. However, this kind of development must first take place and be nurtured in the minds of teachers and instructors.

In spite of observations by some researchers (Olstad et al., 1981) that the cognitive style used by minorities is incompatible with current school practice, we can make their cognitive style compatible with the school curricula. After all, schools are designed for people, not people for schools. Further, since it was noted that Blacks are people-oriented, let them have more group interaction. Relate abstract ideas in a concrete way so that they can learn to develop the skill for cognitively restructuring important information.

Cognitive styles, like other student learning styles, are key to educational improvement. As such, it is important to match students' cognitive styles with appropriate instructional programs. To reiterate, the research evidence clearly supports the view that when students learn in ways that are natural for them, the outcomes are increased academic achievement, improved self-esteem, a liking for learning, improved basic skills, stimulated creativity, and gradual increasing learner independence (Dunn and Dunn, 1979; Olstad et al., 1981; Saracho and Spodek, 1984; Shade, 1984).

It is important, therefore, that instructional strategies should be used that accommodate the variety of cognitive styles associated with different ethnic minority groups. Educational institutions must be sensitive to differences in cognitive styles

of ethnic minorities. Olstad et al. (1981) suggested that such sensitivity may reverse the current condition in schools where minority students are alienated, have high absenteeism, poor academic performance and high drop out rates.

## References

- Aiken, L.R., Jr. (1970). Attitudes toward mathematics. Review of Educational Research, 40, 551-596.
- Broverman, D.M., Klaiber, E.L., Kobayashi, Y., & Vogel, W. (1968). Roles of activation and inhibition in sex differences in cognitive abilities. Psychological Review, 75, 23-50.
- Davis, J.K. & Frank, B.M. (1979). Learning and memory of field independent-dependent individuals. Journal of Research in Personality, 13, 469-479.
- Dunn, R., & Dunn, K. (1979). Using learning style data to develop student prescriptions. In National Association of Secondary School Principals. Student learning styles: Diagnosing and prescribing programs. (pp. 109-122). Reston, VA: NASSP.
- Fennema, E. (1984). Girls, women, and mathematics. In E. Fennema & M.J. Ayer (Eds.), Women and Education: Equity or equality? (pp. 137-164). Berkeley, CA: McCutchan.
- Fennema, E. & Peterson, P. (1985). Autonomous learning behavior: A possible explanation of gender-related differences in mathematics. L.C. Wilkinson & C.B. Marrett (Eds.) Gender influences in classroom interaction (pp. 17-35). Orlando, FL: Academic Press, Inc.
- Goodenough, D.R. (1976). The role of individual differences in field dependence as a factor in learning and memory. Psychological Bulletin, 83, 675-694.
- Hall, P.Q. (1981) Problems and Solutions in Education, Employment and Personal Choice of Minority Women in Science. Washington, D.C.: American Association for the Advancement of Science, Office of Opportunities in Science.
- Hunt, D.E. (1979). Learning style: An overview. In National Association of Secondary School Principals. Student learning styles: Diagnosing and prescribing programs (pp. 1-17). Reston, VA: NASSP.
- Johnson, Sylvia T., & Prom, Sukai E. (1984). Factors Related to Science and Mathematics Career Choice: A Survey of Alumni of A Better Chance, Inc. Final Report submitted to the Ford Foundation, Inc.
- Keefe, J.W. (1979). Learning style: An overview. In National Association of Secondary School Principals. Student learning styles: Diagnosing and prescribing programs (pp. 123-132). Reston, VA: NASSP.

- Kenschaft, P. (1981). Black women in mathematics. American Mathematics Monthly, 88, 592-604.
- Konkiel, E.H. (1981). The interactive effect of the field dependent-field independent cognitive style variable and a solar cueing instructional strategy upon map skills achievement of fourth grade students. Dissertation Abstracts International, 41, 2542A (University Microfilms No. 82-13155).
- Lockheed, M.E., Thorpe, M., Brooks-Gunn, J.; Casserly, P., & McAloon, A. (1985). Understanding sex/ethnic related differences in mathematics, science and computer science for students in grades four to eight. Princeton, NJ: Educational testing Service.
- Maccoby, E.E., & Jacklin, C.N. (1974). The psychology of sex differences. Stanford, CT: Stanford University Press.
- Matthews, W. (1981). Race-and sex-related differences in high school mathematics enrollment. (Doctoral dissertation, Univeristy of Chicago, 1980). Dissertation Abstracts International, 41, 3934A.
- Messick, S. (1979). Potential uses of noncognitive measurement in education. Journal of Educational Psychology, 71, 281-292.
- Moody, C.D., & Linn, E. (1986). Fostering sex equity in math. Ann Arbor, MI: Center for Sex Equity in Schools, Michigan University. (ERIC Document Reproduction Service No. ED 265-071).
- Olstad, R.; Juarez, J.; Davenport, L.; & Haury, D. (1981) Inhibitors to achievement in science and mathematics by ethnic minorities. Bethesda, MD: (ERIC Document Reproduction Service, No. ED 223-404).
- Prom, S.E. (1982). Salient Content and Cognitive Performance of Person - and Thing - Oriented Low Income Afro-American Children in Kindergarten and Second grade. (A doctoral dissertation, Howard University, Washington, D.C.).
- Ramirez, M. III. (1982, May). Cognitive Styles and Cultural Diversity. Paper presented at the Annual Meeting of the American Educational Research Association, New York.
- Saracho, O.N., & Spodek, B. (1984). Cognitive Style and Children's Learning: Individual Variation in Cognitive Processes. A report (ERIC Document Reproduction Service No. ED 247-037).
- Schimizzi, N.V. (1985). Mathematics Achievement Scores in High School: Are They Related to the Way We Teach in the Earlier Grades? A Report. (ERIC Document Reproduction Service No. ED 265 012).

- Shade, B.J. (1984, April). Afro-American Patterns of Cognition A Review of Research. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA (ERIC Document Reproduction Service No. ED 244 025).
- Sherman, J.A. (1978). Sex-related cognitive differences: An essay on theory and evidence. Springfield, IL: Charles C. Thomas.
- Sherman, J. & Fennema, E. (1977). The study of mathematics by high school girls and boys: Related variables. American Educational Research Journal, 14, 159-168.
- Spiro, R.J., & Tirre, W.C. (1980). Individual differences in Schema utilization during discourse processing. Journal of Educational Psychology, 72, 201-208.
- Travers, K.J., & McKnight, C.C. (1985). Mathematics achievement in U.S. schools: Preliminary findings from the Second IEA Mathematics Study. Phi Delta Kappan, 66, 407-413.
- Wolleat, P., Pedro, J.D., Becker, A.D., & Fennema, E. (1980). Sex differences in high school students' causal attributions of performance in mathematics. Journal for Research in Mathematics Education, 11, 356-366.
- Witkin, H.A. (1978). Cognitive styles in personal and cultural adaptation. The 1977 Heinz Werner Lecture. Worcester, MA: Clark University Press.
- Witkin, H.A., & Goodenough, D.R. (1981). Cognitive styles: Essence and origins. New York: International Universities Press.
- Witkin, H.A., Moore, C.A., Goodenough, D.R., & Cox, P.W. (1977). Field-dependent and field-independent cognitive styles and their educational implications. Review of Educational Research, 47, 1-64.